refracting and are being further studied. Sulphuric acid decomposes the mineral with separation of silica and formation of barium sulphate.

An analysis of a hand-picked sample of gillespite, with only a few per cent of other mineral present gave the following results:

Analysis of gillespite		Ratios	
SiO_2	50.08	0.831	4.034 or 4×1.01
FeO	14.60	0.203	0.985 or 1×0.99
BaO	31.02	0.202	0.980 or 1×0.98
Al_2O_3	0.34		
Fe_2O_3	0.56	0.008	.....
Mn_2O_3	0.14		
Insoluble	2.20		
Water[a]	0.82		
	99.76		

[a] Water determined by "ignition loss" corrected for (assumed) oxidation of FeO to Fe_2O_3. Selected pure fragments of gillespite give no water when heated in a closed tube.

The formula of gillespite is $FeO.BaO.4SiO_2$ or $Fe''BaSi_4O_{10}$. If the ferrous iron and the barium be considered as isomorphously replacing each other, then the formula simplifies to $(Fe'',Ba)Si_2O_5$. There is, however, no evidence for such isomorphous replacement and as the ratios of ferrous iron and barium in the analysis are sharply 1:1, the formula $Fe''BaSi_4O_{10}$ is to be preferred.

The presence of the small quantity of manganese was definitely determined and it is assumed to be present in the strongly chromatic manganic state; the combination of such manganic manganese with possibly a small quantity of ferric iron yielding the deep red color of the mineral. Titanium is not present.

There does not seem to be any group of minerals to which gillespite is closely related, considering its properties and chemical composition.

ICHTHYOLOGY.—*Notice of a spiral valve in the Teleostean fish* Argentina silus, *with a discussion of some skeletal and other characters.*[1] WILLIAM C. KENDALL and DONALD R. CRAWFORD, U. S. Bureau of Fisheries.

INTRODUCTION

Distribution.—Argentina silus is found rather infrequently along the Atlantic coast of the United States, although it is not rare off the coast of Norway. The flesh is edible, but *Argentina silus* is not taken in sufficient quantities to be of economic importance.

[1] Received November 19, 1921.

The following are the only records known to us of the capture of the species on the Atlantic coast of the United States. A specimen was found in the stomach of *Physis tenuis* taken off Sable Island in 200 fathoms, which is recorded by Goode and Bean as type number U. S. N. M. 21624, "*Argentina syrtensium*" (Proc. U. S. Nat. Mus., 1878, page 261), and in Oceanic Ichthyology, page 52, as *Argentina silus*.

In July, 1891, a specimen 18 inches long (U. S. N. M. No. 43708) was caught by a boy with a hook and line in the harbor of Belfast, Maine. (Goode and Bean, Oceanic Ichthyology, page 52.) Another, No. 37801, 15 inches (381.0 mm.) long, was taken at Biddeford Pool, Maine (loc. cit.), March 19, 1886.

In 1904, Mr. John R. Neal, of Boston, Mass., sent in for identification by the U. S. Bureau of Fisheries a specimen about 13.5 inches (342.9 mm.) long, taken by a fisherman probably on Georges Bank, September 19 of that year. Another specimen in the collection of the U. S. National Museum, No. 55636, was found at Fletchers Neck, near Ocean Beach, Maine, May 7, 1906.

In the collection of Mr. W. W. Welsh, of the U. S. Bureau of Fisheries, are two young specimens collected on the coast of Maine as follows: 1 specimen 49 mm. long, August 14, 1912, in a closing net at a depth of 35 fathoms, 33 miles north from Mt. Desert Rock. Another, 38 mm. long, August 13, 1913, 25 miles N. E. from Petit Manan light, somewhere above a depth of 110 fathoms.

In December, 1912, a specimen about 15 inches (381.0 mm.) long was found on Hampton Beach, N. J., and was sent to the Bureau of Fisheries by Mr. B. F. Smart, of the U. S. Life Saving Service.

Early in January, 1914, a specimen nearly 14 inches (355.6 mm.) long was found at Hampton Beach and sent in to the Bureau. These latter specimens form the basis for the observations comprised in this paper.

Habits.—Little is known of the habits of this fish. It has been caught in the north Atlantic from Iceland to the coast of Ireland,[2] in rather deep water. The eggs[3] of *Argentina silus* are 3.0 to 3.5 mm. in diameter and are bathypelagic; that is, they float far below the surface where they have been taken in 50 to over 1,000 meters of water.

[2] JOHS. SCHMIDT, *On the Larvae and Post-larval Development of the Argentines* (Argentina silus *Ascan.* and Argentina sphyraena *Linne*). Meddelelser Fra Kommissionenfor Hovunders gelser, Sene Fiskeri, Kobenhavn. **2**: 1–20. Nov. 4, 1906.

[3] *Op. cit.*

It is known that this fish may be caught on bait of mussels (*Mytilus*, according to Nilsson), or on pieces of herring.[4] According to Holt,[5] one specimen caught off the coast of Ireland had in its stomach remains of shrimps and copepods, one of which was identified as *Calamus finmarchichus*, which is known to inhabit the bottom.

VISCERAL ANATOMY

Alimentary Tract and Spiral Valve

The presence of a spiral valve is of considerable interest since up to the present time but one living adult Teleost was known to possess a true spiral valve in the intestine.

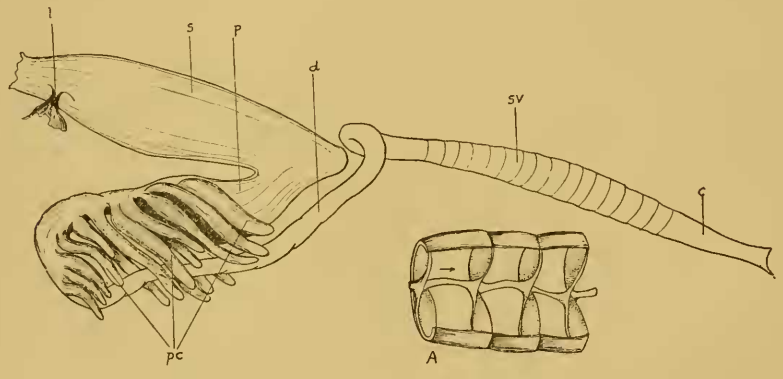

Fig. 1. Stomach and intestine of *Argentina silus* × $^2/_3$.—*l*, attachment of liver; *s*, cardiac limb of stomach; *p*, pyloric limb of stomach; *pc*, pyloric caeca; *d*, duodenum; *sv*, spiral valve; *c*, rectum. *A*, small portion of spiral valve, with part of the outer wall removed to show internal structure, semi-diagrammatic, × 6.

In *Argentina silus* it has no doubt been overlooked partly because its presence hitherto was unsuspected and also because of the comparatively few specimens available for study. It is not known from the limited material examined whether or not this structure is as variable in different individuals of *Argentina silus* as it is known to be in different individuals of some species of rays and sharks. The two specimens at hand were essentially the same, each showing a true spiral cavity wound around a small central canal. Thus, the

[4] F. A. Smitt, *Scandinavian Fishes*, ed. 2, **2**: 916. Stockholm, 1895.

[5] W. L. Holt, *The Great Silver Smelt, Argentina silus*, Nilss. *An addition to the List of British Fishes.* Journal of the Marine Biological Association of the United Kingdom. N. S. **5**: 341–342. 1897–99.

spiral valve in *Argentina silus* is fully as well developed as it is in the ganoids, among which it is very well developed in *Polypterus* and the Sturgeon, but vestigeal in *Lepidosteous* and *Amia* (*Amiatus*).[6]

It is generally believed that the spiral valve is absent in the more specialized Teleostei with the possible exceptions of *Chirocentrus* and possibly some *Salmonidae*. In making the latter exception reference is made to Rathke's work published in 1824.

In discussing the folds of the mucous membrane lining the intestines of various fishes, Rathke[7] mentions crossfolds (Querfalten) and ringfolds (Ringfalten) as occurring in *Clupea alosa*, the grayling (*Thymallus*), whitefish (*Coregonus*), and *Salmo trutta*. While Rathke evidently was aware of the presence of these folds, it is clear that he did not interpret them as spiral valves, for he does not use the term "Spiralfalten" in this connection as he does in describing the spiral valve of the Sturgeon. The more exact meaning of the term "vestige" still remains to be determined; but at present such a discussion seems to be extraneous. As a matter of fact, however, the writers have found that in some specimens of "Rainbow" trout (*Salmo* sp.) there were six or seven well-developed spiral folds in the posterior end of the intestine which will be discussed more fully in a future paper.

Of the remaining Teleosts in which there are so-called rudiments or vestiges of spiral valves, *Gymnarchus*[8] apparently possesses a slight spiral valve which disappears 43 days after hatching. However, according to Cuvier and Valenciennes,[9] there is a well-developed spiral valve in *Chirocentrus*, one of the *Physostomi*. It is described as follows: "Upon opening the intestine, one finds a mucous lining very remarkable for its exceedingly numerous and close-set folds, which, for the whole extent of the canal, form a series of connivant valves, or rather an internal lamina wound in a very compact spiral—*une lame sur une spirale tres-serée*....." The description is supplemented by a drawing which differs from other drawings[10] of the spiral valve of *Chirocentrus*. However, it is apparent that *Chiro-*

[6] PARKER and HASWELL, *A Text-Book of Zoology*, 2: 218. 1897.

[7] HEINRICH RATHKE, *Uber den Darmkanal und die Zeugungsorgane der Fische*, 62–65, 83. 1824.

[8] R. ASSHETON, *The Development of Gymnarchus niloticus*. The Work of John Samuel Budgett. Edited by J. Graham Verr. P. 326.

[9] CUVIER and VALENCIENNES, *Histoire Naturelle des Poissons*, 19: 117; also Pl. 565 between pp. 312–313. 1846.

[10] E. S. GOODRICH, *A Treatise on Zoology*, fig. 77A. Edited by Sir Ray Lankester.

centrus hitherto has been the only Teleost known in which there is a true spiral valve in the adult.

The stomach of *Argentina silus* is siphon-shaped, somewhat like that of a salmon, although the posterior end-curve is conical, suggesting a short caecum. The pyloric limb is the shorter, being about half the length of the cardiac limb.

The duodenum, as it extends forward, curves downward and then upward. It then passes to one side of the stomach near the median line. In the specimen from which the drawing was made (Fig. 1), there were twenty-five pyloric caeca. Just posterior to the stomach, the intestine bends sharply upward and transversely, then backward, after which it runs in a straight line to the anal opening. This part of the intestine is occupied by a well-developed, though simply constructed, spiral valve (Fig. 1*A*). The exterior shows eighteen or twenty transverse septa on a little over two-thirds the length of the straight part of the intestine, but there are several incomplete whorls at the anterior end and a few closely folded ones at the posterior end which do not show externally. Back of the spiral valve, the intestine is a straight tube.

A specimen[11] of young *Argentina silus* 49 mm. long shows a well-developed spiral valve.

The air bladder is thick-walled and silvery, with a small aperture in the posterior end which suggests a pneumatic duct connection but which could not be traced.

SOME SKELETAL CHARACTERISTICS

Cranium.—The most prominent feature in a dorsal view of the cranium is the large frontal bones which extend backward above the eyes and nearly to the posterior margin of the cranium, almost completely covering the parietals. The frontals overlap each other and they are so closely bound together that it is difficult to separate them. When they are removed, the thin and rather narrow parietals are seen lapped underneath these bones. The parietals overlap each other widely and also cover the supraoccipital except for the supraoccipital crest and a narrow posterior margin. The supraoccipital bone is extended foreward into a tongue-shaped process upon which the parietals rest. This process is connected by a cartilaginous bridge

[11] In the collection of Mr. W. W. Welsh, U. S. Bureau of Fisheries. Grampus station 10027. August 14, 1912.

to the sphenotic bones on each side and a narrower ridge extends upward on the inner side of the alisphenoid. There is a cartilage extending downward between parts of the opisthotic[12] and epiotic bones.

The parietals extend laterally and cover the large pit on either side which is bounded by the opisthotics, pterotics, and epiotics. This pit is filled ordinarily by the foreward extension of the large lateral muscles of the body. In *Salmo*, this pit is bounded by the same bones as in *Argentina*, but it is not covered over by the parietals. In *Osmerus*, the pit is bounded by the pterotic and epiotic, the parietals not covering it. Neither do the parietals in *Osmerus* meet in front of the supraoccipital.

The preoperculum falls almost perpendicularly from its fascet. Its two limbs form nearly a right angle, the lower limb which extends forward being as long as the upper, and both are connected at the angle by a heavy flange which is roughly quadrate in outline. The metapterygoids are much reduced. The large mesopterygoids extend downward between the metapterygoids and quadrate bones.

The symplectic extends from the hyomandibular diagonally downward to the top of the lower limb of the preopercle and thence forward. A part of the quadrate bone extends backward on top of the lower limb of the preopercle and overlaps the forward extension of the symplectic. The whole apparatus has the appearance of being drawn downward and forward. There are no teeth on the mesopterygoids,[13] maxillaries, or premaxillaries, but there are small, sharp teeth in single rows on the anterior margin of the vomer and palatines, and a few on the tongue. The preorbital and three suborbital bones extend from the premaxillary backward across the cheek. There is no supplementary maxillary. The premaxillaries are securely fastened to the vomer by connective tissue which makes these bones immovable.

The upper margin of the bones of the lower jaw is strongly arched, the apex of the arch being at the overlapping of the dentary and articular bones. The anterior margin of the dentary is concave and toothless, but it is hard and chisel-edged. Between the dentary and articular bones is a splenial bone, which lies on top of the Meckel's car-

[12] Regan did not recognize the existence of the opisthotic bone in the skull of *Argentina*. It may be seen to best advantage after the frontals and parietals are removed.

[13] There are teeth on the mesopterygoids of *Osmerus*.

tilage. The upper and outer surface of this bone forms a broad contact with the inner surface of the articular. The articular is heavily reenforced on the inner surface at its articulation with the quadrate. The angular bone is present.

Vertebrae.—There are thirty-six abdominal and thirty caudal vertebrae in the vertebral column of our specimens of *Argentina silus*.[14] In the first twenty-one abdominal vertebrae, the neurapophyses are not fused into neural spines and the neural canal is not closed above in the first twenty. The neural canal is closed in the twenty-first, but there are still two neural spines. The parapophyses of the abdominal vertebrae extend outward as rather broad, rhomboidal platforms which lie nearly horizontal, the ribs being attached to the outer corners. The parapophyses become progressively narrower posteriorly and gradually merge into the haemapophyses of the caudal vertebrae. There are ribs on all but the last three abdominal parapophyses. In *Salmo*, the first two abdominal vertebrae do not bear ribs.

Epipleurals are borne on at least twenty-six of the abdominal vertebrae. These bones are ankylosed with the neural spines and may not be separated from them without breaking them apart. The neurapophyses of these vertebrae are articulated loosely to the centra and each may be lifted off of the centrum with the attached zygapophysis and epineural. In those vertebrae which do not bear epineurals, the neurapophyses are ankylosed with the centrum. None of the epipleurals of *Salmo* or *Osmerus* are ankylosed with the neurapophyses.

In the caudal vertebrae, the haemal arch is closed, but in the first nine, the haemapophyses extend downward separately, but they are bridged across by an arch instead of a solid, straight-edged connection, as in *Salmo*. They increase in length posteriorly and taper inward toward each other until, in the tenth, there is a single haemal spine. The 45th vertebra is shown in figure 2, *E*. The last undoubted vertebra is much like that of *Osmerus*. The caudal stylus is composed of elements extending from the upper and lower sides of the centrum whose axis is directed slightly upward. The upper element of the stylus is the heavier, while the reverse is true in *Osmerus*. However, there are three rather indistinct vertebrae whose axes are directed

[14] The following numbers of vertebrae in *Argentina silus* are recorded in various ichthyological works: Day, 65; Smitt, 65–68; A. Schubberg, 66.

upward posterior to the stylus, while in *Osmerus* this is not the case. (Fig. 2, *D*.)

Pelvic Bones.—The pelvic bones differ widely from those of other Isospondyli. There is one distal pterygiophore loosely articulated to the basipterygium. Above it, there is a large, spheroidal swelling of hard bone excavated on the inner side to which the first ray is articulated. From this spheroidal swelling, a slender shaft projects

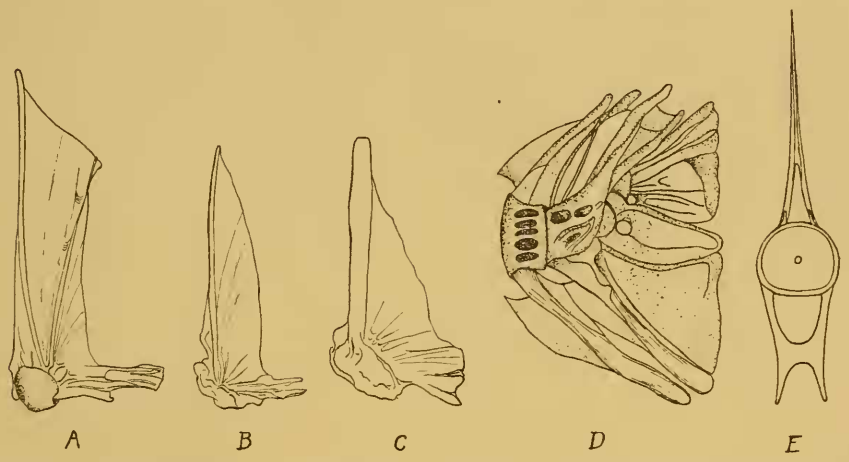

Fig. 2. *A*, basipterigium of *Argentina silus*, × 1½; *B*, basipterigium of *Osmenus mordax*, × 3; *C*, basipterygium of *Salmo sebago*, × 2; *D*, caudal vertebrae of *Argentina silus*, × 2; *E*, 45th vertebrae of *Argentina silus*, showing the arched connection between the haemopophyses, × 2.

forward along the margin and another shaft, originating at the base of the first, runs diagonally forward across the basipterygium. The anterior margin of the basipterygium extends diagonally across the ends of the two shafts, the whole bone being trapezoidal in shape, as shown in figure 2, *A*. In this respect, it differs from the basipterygia of other Isospondyli which are roughly triangular in outline. (Fig. 2, *B*, *C*.) A lateral process extends inward to meet a similar process on the opposite side.

Pectoral Girdle.—There is no postclavical such as that found in a salmonid. The actinosts are thin, but they are connected by webs of bone. The mesocoracoid is present and well developed. The supratemporal is a thin, blade-shaped bone loosely attached to the upper posterior margin of the supraoccipital. Of the two processes of the posttemporal bone, the lower which curves downward is the

longer. It is firmly attached to the base of the exoccipital by tough connective tissue.

The pectoral girdle is further attached to the skull and vertebrae by three rod-like ligaments on each side. The upper ligament passes from the posttemporal to the basioccipital. The second is attached to the supraclavical and the first vertebra which is ankylosed with the skull. The third ligament attaches the clavical to the second vertebra, or the first which is not ankylosed with the skull.

Scales.—The scales of *Argentina silus* differ greatly from those of *Osmeridae* or *Salmonidae*. In these two families, the scales are smooth and cycloid, but in *Argentina silus* they are roughened by small spines, and they are ctenoid in a manner similar to certain clupeids and percids (Menhaden and *Stizostedion*). The heart-shaped scales as described by Smitt appear only along the lateral line.

SUMMARY OF CHARACTERISTICS OF *Argentinidae* AS INDICATED BY *Argentina silus*

Visceral characteristics

Stomach bluntly caecal; intestine *with well-developed spiral valve;* pyloric caeca much less numerous than in *Coregonidae*, not much less numerous than in *Salmonidae*, and much more numerous than in *Osmeridae;* air bladder thick and silvery; pneumatic duct, if any, connected with its posterior end.

Skeletal characteristics

Cranium:—Frontals extend backward overlapping parietals, nearly covering them. Parietals overlapping on top of supraoccipital; opisthotic present; splenial bone present in lower jaw; mesopterygoids and jaws toothless; no supplementary maxillary.

Vertebrae:—66 all told. Double neural spines in first 21, canal being open in first 20. Ribs on all but last three abdominal vertebrae. Osseous epipleurals on at least 26 abdominal vertebrae; these are ankylosed to zygapophyses and neural spines; haemapophyses of abdominal vertebrae bridged by arch instead of straight-edged piece as in *Salmo;* pelvic bones with trapezoidal instead of a triangular basipterygium.

Pectoral girdle:—With no postclavical process and with thin actinosts which are connected by webs of thin bone.

Scales:—Ctenoid. Modified along lateral line.

SYNOPSIS AND REVIEW OF THE HISTORY OF THE CLASSIFICATION OF *Argentina*

The statement by Linnaeus that there are teeth on the jaws and tongue[15] ("*Dentes* in maxillis, lingua") is not borne out by Artedi[16] to whom Linnaeus refers, or by subsequent descriptions. Artedi says teeth on tongue and palate ("*Dentes* in lingua & Palate"). Furthermore, Linnaeus states the branchiostegal rays as 8. Artedi does not mention the number but all subsequent descriptions state them as 6. While Linnaeus does not mention the number of pyloric caeca it is interesting to note that Artedi says that there are 6 or 7. Both of the foregoing refer to the Mediterranean species *Argentina sphyraena.*

In their discussion of the genus *Argentina,* Cuvier and Valenciennes indefinitely mention numerous caecal appendages[17] and state that the stomach ends in a cul-de-sac. The genus is included in "Salmonoides." Gunther[18] says: Pyloric appendages in moderate numbers. He refers the family to *Salmonidae,* which includes *Salmo, Oncorhynchus, Brachymystax, Luciotrutta, Plecoglossus, Osmerus, Thaleichthys, Hypomesus, Mallotus, Retropinna, Coregonus, Thymallus, Argentina,* and *Microstoma* comprised in the first group Salmonina, in the order named.

In recognizing the subfamily *Argentininae* of Bonaparte, Gill states that it differs from *Salmoninae* by the stomach ending in a blind sac posteriorly. In this he agrees with Cuvier and Valenciennes. Gill's original observations, however, were apparently on the smelts and allied forms. In the subfamily he recognized two genera, *Argentina* and *Silus,* the first with cycloid, the other with spinigerous scales. Later Gill placed the subfamily *Argentininae,* comprising *Mallotus, Osmerus* and *Microstoma,* also by implication, other Osmerids and *Argentina,* in the family *Microstomidae.*[19] Ten years later, however, Jordan and Gilbert include *Argentina* in the family *Salmonidae,* recognizing no subfamilies in the description of the genus, thus following Gunther.

[15] *Systema Natura:* 315. 1758.

[16] *Ichthyologia,* 5: 8. 1738.

[17] *Histoire Naturelle des Poissons,* 21: 299. 1898.

[18] *Catalogue of the Physostomi, British Museum,* p. 202. 1866.

[19] *Catalogue of the Fishes of the East Coast of North America.* Smith. Misc. Coll. 1873: 11–32.

Without stating any additional characters, Gill, in 1884, established the family *Argentinidae*.[20] By inference the family distinction is that of the caecal stomach.

Smitt[21] retains *Argentina*, as well as the Osmerids, etc., in *Salmonidae*. In his diagnosis of the genus, no character of more than generic value is mentioned. In expressing the relationship of *Argentina* to other forms, however, he says that the odor and few pyloric appendages point to the Smelt and the stiff but fragile fin rays and the singular shape of the scales are reminders of the Scopelids. Also that the peculiarity of the scales suggests the extinct genus *Osmeroides*, which, however, in its numerous branchiostegals and dentition was more like the salmon. Jordan and Evermann accept *Argentinidae*, of Gill, comprising the Osmerids, etc., as well. Their characterization is largely composed of the generic characters of the Osmerids. They state that the stomach is a blind sac, and the pyloric caeca few or none. Following the family diagnosis, the statement is made that there are about ten genera and perhaps a dozen species which are reduced *Salmonidae* smaller and in every way feebler than the trout, but similar to them in all respects except in the form of the stomach.

More recently Regan separated the Osmerids from the *Argentinidae* making for them the family *Osmeridae*, the latter differing from the *Argentinidae* in having toothed mesopterygoids. Both the *Argentinidae* and *Osmeridae* he supposed to differ from the *Salmonidae* in the absence of opisthotics and upturned vertebrae at the posterior end of the vertebral column.

Unless the ensemble of previously designated generic characters of *Argentina* is considered of family rank, no one prior to Regan has enunciated a valid family character, and even he was mistaken concerning the absence of the opisthotic in *Argentina*. However, its presence in *Argentina* and absence from the Osmerids strengthen the family rank of the latter. The fact that *Argentina* possesses opisthotics and vestigial or rudimentary upturned vertebrae, as previously indicated, might be construed by some to show that the genus represents an intermediate between the Osmerids and Coregonids, and even the shape of the stomach as represented by our specimens of *Argentina silus* would support this view. However, there are

[20] Annual Report of the Board of Regents of the Smithsonian Institution for the year 1884 (1885), p. 619.

[21] *Scandinavian Fishes*, 2: 912. 1895.

other characters in which they diverge but in which they should intergrade if they represent true intermediates in a direct line of development. Most of the characters, as well as those mentioned by Smitt and others enumerated in the classifications of *Argentina*, show resemblances merely, rather than actual indications of relationship. And those resemblances represent some of the Salmonoid tendencies of characters possessed by the generalized ancestral form, *Argentina* being a highly specialized terminal product of an early divergent. The fact that it is a comparatively deep water group, of apparently wide distribution, possessing an intestinal spiral valve, considered together with its general structure, would support this view.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. The abstracts should conform in length and general style to those appearing in this issue.

GEOLOGY.—*The New Salem lignite field, Morton County, North Dakota.* EUGENE T. HANCOCK. U. S. Geol. Surv. Bull. **726-A.** Pp. 39. 1921.

The New Salem field is part of the great lignite region of western North Dakota and adjacent regions. The history, commercial geography, and surface features of the area are summarized in two pages. Six pages are given to the discussion of the geologic section which includes the Lance and Fort Union formations. Within the Lance is the Cannonball marine member which has been the subject of much recent discussion and is named from the Cannonball River traversing this field. One bed of lignite was found in the Lance below the Cannonball member, but the valuable beds are confined to the upper 200 to 300 feet of the Fort Union.

The beds in most of this field have a very gentle dip (5 to 10 feet to the mile) toward the northwest, with minor folds; in the northwest part of the field they form a gentle syncline. About three pages are given to physical and chemical data and graphic sections of the coal in considerable detail. The heating value ranges about 6,000 to 7,000 calories for coal as mined. Fourteen pages are devoted to a description by townships of the occurrence of the coal in the seventeen townships examined.

MARCUS J. GOLDMAN.

GEOLOGY.—*Ground water in the Southington-Granby Area, Connecticut.* HAROLD S. PALMER. U. S. Geol. Surv. Water-Supply Paper **466.** Pp. 213. 1921.

This paper is the fourth to appear of a series of detailed reports on the ground-water resources of selected areas in Connecticut. The first part is of a general character and treats of the water-bearing formations, occurrence and recovery of ground water, and its quality. This is followed by descriptions of the eighteen towns included in the area, which is partly in the Central Lowland and partly in the Western Highland of Connecticut.